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ABSTRACT

A study was conducted to determine whether or not the Personalized, Individualized, Vocational Occupations Training (PIVOT) materials developed by the School District of Philadelphia were capable of developing entry-level competency in secondary school students in a variety of educational settings (comprehensive high schools, an occupational school for educable mentally retarded, a skills center, and an area vocational-technical school) and subject areas (nurse's aide, industrial electricity, automotive mechanics, and machine tool trades). Experimental classes, using the PIVOT materials, were taught by means of individual sound-on-slide projectors, while control classes were taught the same material by conventional methods. Comparison of rates of success on a criterion task in each subject area proved the PIVOT method capable of developing entry-level competency in each setting. No significant differences were detected however between effects of the PIVOT materials and conventional methods except for educable mentally retarded students, who learned significantly better with the PIVOT materials. Repetition of the experiment with larger groups of students is recommended. Appendixes, which comprise three-fourths of the document, include lists of PIVOT units, the criterion tasks and checklists for units used in the research, the rating form for individual slides and definitions of possible defects, samples of printed materials used with the PIVOT units, and the research questionnaires. (Author/BM)

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Final Report

Project No. 498AH50297
Grant No. G007500452

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U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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EVALUATION OF PERSONALIZED, INDIVIDUALIZED, VOCATIONAL OCCUPATIONS TRAINING

March 1977

U.S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE

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AUTHOR'S ABSTRACT

This study was intended primarily to determine whether or not the Personalized, Individualized, Vocational Occupations Training (PIVOT) materials developed by the School District of Philadelphia were capable of developing entry-level competency in secondary school students in a variety of educational settings and subject areas. Experimental classes, using the PIVOT materials, were taught by means of individual sound-on-slide projectors, while control classes were taught the same material by conventional methods. The rates of success on a criterion task in each subject area were compared to determine the relative effectiveness of the PIVOT and conventional methods of instruction. The PIVOT method proved capable of developing entry-level competency in students in each of the settings in the study. Sample sizes, however, were inadequate to allow significant differences, if any, to be detected between the PIVOT and conventional methods, except in the case of Educable Mentally Retarded students, who learned significantly better with the PIVOT materials than when taught by conventional methods. Repetition of the experiment with larger groups of students is recommended to determine whether or not significant differences exist between the effectiveness of the PIVOT and conventional methods in other settings.

Final Report

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Grant or Contract No. G007500452

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Stanley B. Cohen,
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Office of Education
National Center for Educational Research and Development

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INTRODUCTION

For five years, the School District of Philadelphia has been developing a series of sound-on-slide instructional units in various vocational areas for use in what is known as the Personalized, Individualized, Vocational Occupations Training (PIVOT) program. This system of instruction allows the individual student as much time as necessary to complete each instructional unit, which consists of a tray of slides with recorded instructions in the slide holders and various printed materials, including pre- and post-tests on the unit. Each unit teaches the student a single, small task; the intended overall effect of a series of such units is to develop a vocational competency based on a combination of the tasks taught by the various units.

The individual PIVOT units are given to the student at a "work station" equipped with a sound-on-slide projector and the tools and materials needed for the completion of the particular sound-on-slide unit. After the student believes that he is capable of performing the task taught by the unit (he uses the self-evaluation instrument provided with the unit to determine this), the instructor administers a post-test. Only students who pass the post-test are permitted to advance to the next unit of instruction, so that successful completion of a series of units implies that all post-tests in that series have been passed. What is not ascertained within the system itself, however, is whether or not a student who has successfully completed a series of units can perform a larger task combining the various skills acquired in the completion of a number of separate units logically related to the larger task. The need for this determination under controlled experimental conditions was one of the main motivations for the present study.

The experimental nature of the present study mandated the use of certain procedures which were perhaps more rigorous than would be required in ordinary classroom use of the PIVOT system. It was desired, for example, that teachers involve themselves as little as possible in teaching the same subject matter as that presented in the units, in order to determine the effectiveness of the sound-on-slide units alone. The modular design of the PIVOT system makes it highly adaptable to local settings, and instructions are provided for modification of the sound-on-slide units at the level of the individual classroom, if necessary, to make the units maximally effective. In the present study, however, the need for uniformity of experimental conditions precluded modification of the units. Therefore, any mismatching between the materials shown in the slide units and those available in the individual shops used in the study may have had a more serious effect on the outcome of the experiment than would have been the case in actual classroom implementation.

The purposes of the present study were (1) to determine whether or not students trained by means of the PIVOT system demonstrated job entry competency in their area of instruction; (2) to determine whether students trained by the PIVOT system demonstrated proficiency equal to or greater than that of students trained by conventional methods; (3) to determine whether ability to profit from the PIVOT system of instruction was related to academic achievement; and (4) to determine whether Educable Mentally Retarded (EMR) and bilingual (Spanish-English speaking) students were able successfully to utilize the PIVOT method of instruction.

In order to answer these questions, an experimental design was implemented during the 1975-76 academic year in various comprehensive high schools, area vocational-technical schools, and one EMR occupational school in Philadelphia. Students who had used the PIVOT method of instruction in the newly-opened skills center were also tested, but were not included in a formal, controlled experiment, since no suitable control classes were available which were trained by conventional methods in a setting like a skills center.* In each of the other settings, one class in each subject area (i.e., Industrial Electricity; Machine Shop; Automotive; or Nurse's Aide, in the case of the EMR students) was instructed by the PIVOT method, and another class, in a different school, was instructed in the same subject matter by conventional methods. At the conclusion of their training, students were given a criterion test, constructed and administered by representatives from industry and School District of Philadelphia subject matter specialists, to determine whether or not they could successfully perform tasks based on the content of the PIVOT materials. The rates of success in the experimental and control classes were to be compared by appropriate statistical tests to determine the relative effectiveness of the PIVOT and traditional methods of instruction.

The scope of the present study was selected in order to sample all of the settings in which the PIVOT system will be used in the School District of Philadelphia, and the various types of students with whom it will be used. The skills centers are expected to utilize the PIVOT system as their main means of individualized instruction; a computer-managed individualized instructional system lies at the very heart of the skills center concept. Thus an examination of the effectiveness of the PIVOT system in a skills center was considered very desirable, even through a controlled experiment was not possible in that setting. The comprehensive high schools and the area vocational-technical schools are both expected to utilize the PIVOT system on a growing basis, as materials become available. The emphasis on "mainstreaming" of EMR students from special classes into regular classes, and the fact that the sound-on-slide system was apparently well suited to use by poor readers made its testing with EMR classes quite desirable. The selection of subject areas and settings was designed to provide as broad a cross-section of the Philadelphia vocational education spectrum as could possibly be incorporated into one study. In retrospect, however, this emphasis on diversity may have been one of the main weaknesses of the study, causing sample size in individual settings to be smaller than is usually considered desirable. More will be said about this aspect of the study in the chapter on "Results."

*The Philadelphia skills centers are centralized career education facilities offering training in a variety of vocational subjects to students enrolled in public or parochial high schools in their area. They feature individualized learning situations designed to prepare the students for specific career goals, and operate on an open entry-open exit system, with the emphasis on individual student progress rather than class progress. At the time of the study, the first of the six skills centers that are planned for Philadelphia was open, and was included in the study.

PROCEDURES

The basic design of this study involved teaching the same vocational subject matter to different groups of students by two different methods (i.e., the PIVOT method and the traditional method of teaching the same meterial) and then comparing the rates of success on a criterion task administered to all of the students at the completion of their training. In order to do this, it was necessary to locate suitable classes and teachers and to train the teachers in the use of the PIVOT method (or else to inform them of what they were to teach by their conventional methods). Consultants were needed to aid in the construction of the criterion tasks and to administer the tasks to the students. Procedures for the actual testing of the students had to be developed. This section details the various procedures followed during the course of the experiment, essentially in chronological order.

Site and Staff Selection

The first activity to which the project manager and research assistant addressed themselves was the selection of the schools involved in the study. It was necessary to have shop classes in each of the subject areas, in both the comprehensive high schools and the area vocational-technical schools. The control classes in each subject were to be in different schools from the experimental classes to minimize the effect of cross-contamination between the methods of instruction. There were five subject areas specified in the proposal: Industrial Electricity; Automotive; Machine Shop; Drafting; and Nurse's Aide, with Educable Mentally Retarded (EMR) students only. For reasons that will be detailed later in this section, Drafting was later dropped from the study, as was the bilingual component of the experiment, but schools for those subjects were initially selected.

Since only one skills center was in operation in Philadelphia at the time of the experiment, that one was used for the feasibility study of the use of the PIVOT method in a skills center. An occupational school (that is, a school specializing in the vocational training of secondary level Educable Mentally Retarded students) was selected for use with the Nurse's Aide materials. In the case of the EMR students, it was considered desirable to use two classes in the same school, so that the experimental and control students would be as similar as possible. The same teacher taught both the experimental and control classes in the same room, with the same equipment, but at different times during the day. The control class had no access to the PIVOT materials, and was taught entirely by the teacher's conventional methods.

For the bilingual experiment, a survey was made of the bilingual student population in shop classes throughout Philadelphia; it was found that only one high school had a sufficient concentration of bilingual shop students to make the study feasible. Unfortunately, these students were in the Automotive shop, so that the subject to be taught to them was changed from Machine Shop, as specified in the proposal, to Automotive.

The rest of the schools to be used in the study were selected in the following manner: (1) a pool of schools was identified which taught courses approved by the Pennsylvania State Department of Vocational Education; (2) schools which had courses in each subject area used in the study were randomly assigned to the experimental and control methods of instruction, with separate selections being made for the comprehensive high schools and the area vocational-technical schools.

A deviation from this random process took place in the case of schools in the original pool where a teacher was located who had already used the PIVOT method in class. Since the control teachers would be using their own methods of instruction, in the familiar setting of their established shops, it was considered desirable to use teachers already familiar with the PIVOT method as experimental teachers, wherever possible. The rest of the teachers in the study were randomly selected, except as described in the preceding paragraph.

Once suitable schools were located, teachers of the required courses were identified, in consultation with the principals and department heads in the schools. Only teachers who expressed a willingness to participate in the experiment were selected. It was also necessary to match the number of years

of previous instruction of the students in the experimental and control classes. Some replacements of the originally-selected schools were necessary in order to meet these additional criteria. Replacements were selected randomly from the remaining schools.

The group of classes finally selected included one experimental and one control class in each of the four subject areas in the comprehensive high schools, and one experimental and one control class in the same four areas in the area vocational-technical schools. There was one experimental and one control class in the EMR occupational school, and one experimental and one control class in the high school selected for the bilingual experiment. At the skills center, it was arranged that tests would be administered to students who had used the PIVOT materials in the Industrial Electricity, Automotive, and Machine Shop areas (Drafting and Nurse's Aide were not taught at the skills center used in the experiment, although they may be taught at other skills centers, when they open).

Staff Development Activities

Following the selection of staff members at the participating schools, a series of eight staff development meetings was started. After an initial orientation meeting attended by all of the personnel involved in the project the rest of the meetings were attended by either the experimental or control teachers, on different days. The dates and purposes of the various meetings are presented in Appendix A.

Selection of Units to Be Taught

At the first staff development meeting, attended by both the experimental and control teachers, the teachers were grouped according to occupational area. A list of the available PIVOT units in their area was given to each group of teachers. They were then asked to agree on a reasonable number of PIVOT units that all of them could teach, considering the tools and materials available in their shops. Other factors also had to be considered in selecting the units to be taught. Since the first staff development meeting was not held until October 21, 1975, and the school year had already started, units were needed that would not have already been taught in class by conventional methods before the sound-on-slide units were put into use. Also, the units should have some logical relationship to each other, to allow construction of a single criterion task for all of them together. It was necessary that all of the teachers in a subject area teach the same material in both the experimental and control classes so that a single criterion task could be used in each subject area. In consultation with their department heads (some of whom were present at the meeting) and with the research assistant and project manager, the groups each chose a body of units that they believed could be taught during the experiment, and from which a criterion test could later be constructed. The original lists of units given to the teachers are shown in Appendix B, and the units that they finally agreed they could teach are shown in Appendix C. The Career Education Division of the School District of Philadelphia then replicated a sufficient number of slide units so that each experimental teacher was provided with one complete set of the PIVOT units to be used in his area.

Selection of the Consultants

Ten consultants were utilized in the project, two for each occupational area. One consultant in each area came from private industry and one from the School District of Philadelphia's administrative staff. Each consultant had industrial and/or educational expertise in his specific subject area. To locate the industrial consultants, project personnel contacted the Coordinator of the Advisory Council for Career Education for the School District of Philadelphia, who was able to secure the cooperation of various industrial companies, so that they would allow their personnel to participate in this experiment. School district personnel who served as consultants were located by consultation with the Career Education Division of the School District of Philadelphia. The consultants agreed to participate in the development of the criterion tests, in the actual testing of the students, and in an evaluation of the quality of the slides used in the instructional units. They also completed a questionnaire at the end of the experiment, explaining their reactions to the PIVOT system.

Development of the Criterion Tests

The criterion tests (or tasks) consisted of various operations that the consultants judged a student should be able to perform after having successfully completed the appropriate slide units. Each task was a combination of smaller jobs taught in the individual slide units, and upon completion of the task, the student was graded "Pass" or "Fail" by the consultants, who were present at the testing sessions. The criterion for passing was whether or not the student had displayed "entry-level comptency" in the task. The only limitations placed on the task the consultants designed were that it should be reasonably brief (twenty minutes or less) to allow testing an entire class in one day, one at a time, and that it be based entirely on the content of the slide units in that subject area.

In each of the subject areas, the consultants viewed the slides, verifying that the content and technical quality were suitable for the purposes of the experiment. They then suggested a criterion task for each area, and a checklist to be used for their own guidance as they watched the students carry out the criterion task. These initial tasks and checklists were then field-tested in schools not involved in the experiment, in order to refine them, and to give the consultants and the experimenters practice in conducting the testing. As finally refined, the tests were able to be administered in less than twenty minutes per student, and were considered by the consultants to be suitable for the purposes of this experiment. Copies of all these instruments are presented in Appendix D.

It was during the development of the criterion tests that a major problem was discovered in the Drafting area of the study. After viewing the Drafting slides, both consultants agreed that the techniques depicted in the slides were not considered to be in keeping with industrial standards. It was said that even those students who mastered the content of the slides would not have been able to pass any meaningful test of entry-level competency. Inasmuch as no suitable Drafting slides were available, it was decided that the Drafting area would be dropped from the experiment.

Examination of Individual Slide Quality

It was considered desirable to verify in some objective way that defects of a serious nature did not exist in the slide units used in the experiment. Therefore, in addition to the preliminary examination of the slides during the construction of the criterion tests, the consultants agreed to participate in a more extensive review of the units on a slide-by-slide basis.

In consultation with personnel experienced in the production of sound-on-slide units, project personnel constructed a checklist of possible defects that could be present in a sound-on-slide unit from the standpoint of both content and technical quality. A list of objective definitions of possible defects was also written to provide for greater uniformity of ratings in different subject areas with different consultants. A copy of the rating form and the list of definitions will be found in Appendix E.

Meetings were scheduled at which the consultants in each area met with the project manager and the research assistant and examined the slides in the units individually. Attention was also paid to the overall sequence of the slides and the logic of the units. Consultants' comments were entered on a rating sheet for each slide unit during the viewing sessions. The total number of slides examined by each pair of consultants was:

Industrial Electricity:	115 slides
Machine Shop:	163 slides
Automotive:	126 slides
Nurse's Aide:	97 slides

While varying numbers of defects were identified at these sessions, no area had defects of either sufficient seriousness or number to warrant a statement that the slides would be unsuitable for the purpose of this experiment. Therefore, no new activities took place on the basis of these slide review sessions.

Classroom Implementation

Classroom implementation of the experiment required that the experimental teachers be provided with sound-on-slide projectors; five per teacher was considered the most that could be accommodated by existing shop conditions. Some teachers were not able to utilize that many, but were given five machines and told to keep the extras as spares in case of mechanical problems.

Each teacher received a complete set of slides in his subject area and printed materials to accompany the slide unts (see Appendix F for samples). Although teaching had originally been scheduled to start in September, 1975, the sound-on-slide projectors were not received from the manufacturer until late in December, 1975. Before they could be distributed to the teachers, warranty provisions required that the machines be individually checked by the manufacturer's servicemen. Distribution of the machines and related materials was finally accomplished by the end of January, 1976.

Once machines were delivered, each shop teacher had to set up "work stations" at which students could use the PIVOT materials in relative privacy. Some of the teachers discovered that they lacked some of the items specified in the slide units, or that the brand that they had was not exactly the same

as the equipment pictured on the slides. This sort of mismatching of equipment was soon discovered to be a major impediment to successful implementation of this study, since the adaptability of the units to local classroom conditions, in ordinary use, was not suitable for the present experimental conditions. The students required a great deal of help, in some cases, in order to be able to apply the instructions to different equipment. Therefore, an effort was started in February and March, 1976 to provide as much matching equipment as possible to the teachers who needed it. Because testing had to start by the end of April, however, the number of students able to complete the entire series of slide units was rather small in some classes. More details about this are given in the section on "Results."

Once teaching had started in the experimental classes, the control teachers were told to begin teaching the same material to their students. There were, as might be expected, fewer problems with missing items in the control classes, and the control teachers did not, as a whole, seem concerned about this. Also, since they taught the subject matter of the experiment to their entire class at once, the available time (February to April) did not pose any serious problems for them.

Administration of the Criterion Tests

The consultants and project personnel administered the criterion tests to all of the students in the study between April 29 and June 11, 1976. At each testing session, a work station suitable for the task to be performed was set up in an area of the shop not visible to the students not yet tested. After testing, students were sent to another classroom, so that they would not communicate with students who had not yet been tested. In some cases, the reverse procedure was followed: students who had not been tested were kept in another room and those who had been tested remained in the shop after the test. In all cases, however, no significant communication occurred between those who had been tested and those who had not.

Before each student was tested, the work station was restored to its original condition, so that all students were presented with identical initial conditions. The instruction sheet for the test (see Appendix D) was read aloud to the student, and then given to him to refer to during the test. The consultants then watched the student carry out the criterion task, referring to their checklists of points to be covered. They answered questions the student asked, but took into consideration whether or not the answers to such questions made any difference in whether or not the student could be said to have developed "entry-level" mastery of the task. At the conclusion of the task, the consultants rated the student "Pass" or "Fail," without informing either the student or his teacher of the test results. Those students who obviously could not perform the criterion task were dismissed by the consultants after a reasonable time, and were failed on the test.

It was during the administration of the criterion test to the bilingual students that a crucial discovery was made concerning that phase of the experiment. The teacher of the bilingual students (taking the Automotive course) had said that he was going to teach one of his classes by the PIVOT method and one by the control method. Unfortunately, shortly after he received his PIVOT materials, he developed the first of a series of illnesses lasting several weeks.

The department head at the school, who had been assured by the teacher that he would shortly return to work, did not employ a qualified substitute for the classes, so that the experiment was held in abeyance pending the teacher's imminent return. Once back at work, the teacher became ill again, and a qualified substitute could not be located. By April 30, 1976, the teacher was back at work, and assured the project personnel that his students had completed all of the PIVOT units prior to his absence and had found them very easy. On that basis, it was decided to test his students on May 12, 1976.

When the consultants and the research assistant arrived at the school, the teacher informed them that there was no control group, since all three of his classes had used the PIVOT units. Since the bilingual study was intended to be a feasibility study, it still seemed reasonable to test the students who had used the units, but only six such students could be located in all three classes, and all of them failed the test. Two of these denied having used the units, although the teacher insisted they had. Of the 19 bilingual students the teacher said were eligible for testing, 13 were unaccountably missing. It was the opinion of the consultants that the conditions of this phase of the experiment could in no way be claimed to be a fair test of the PIVOT materials, and the bilingual data have therefore been omitted from this report.

Questionnaires

One area in which a great deal of information was potentially available concerned the problems teachers encountered in implementing the PIVOT system in classrooms where it had never before been used. The perceptions of actual users of the system were expected to be of considerable interest to those planning to implement the PIVOT materials in the future. During the 1975-76 school year, questionnaires were completed by the teachers of the experimental and control classes, by teachers at the skills center, and by the consultants. Copies of all these questionnaires will be found in Appendix G.

Data Analysis

The nature of the data derived from the criterion tests (Pass/Fail), the fact that the California Achievement Test reading scores were treated categorically (1st to 15th percentile, 16th to 49th percentile, and 50th percentile and above), and the two treatment categories (Experimental/Control) all indicated that the use of a non-parametric test (the Chi-square test) would be most appropriate for analysis of the data derived from this experiment. While examination of the percentages of students passing and failing in the experimental and control groups might at first appear to be a suitable means of comparing the effectiveness of the two methods of instruction, a valid statistical test of significance requires that the actual numbers of students involved be considered in the analysis. After collection of the experimental data, it became apparent that a test better suited for use with very small samples (the Fisher Exact Probability Test) would be the best means of analysis for some of the data. More discussion of the statistical procedures used will be found in the "Results" section of this report.

RESULTS

The present experiment was conducted to achieve the following objectives:

Objective 1

To determine whether, after having successfully completed one school year in one of the following courses:

a) Nurse's Aide
b) Industrial Electricity
c) Automotive Mechanics
d) Machine Tool Trades

in which the Personalized, Individualized, Vocational Occupations Training (P.I.V.O.T.) system was used, students will be able to demonstrate job entry competency in an assigned trade task according to prevailing industry standards, as judged by knowledgeable personnel from industry and from the Trade and Industrial section of the Division of Vocational Education of the School District of Philadelphia.

Students in each of the experimental settings and in the skills center were given a criterion task to perform after they had completed all of the assigned units in their area. A summary of all of the settings and areas in which testing took place, and of the test results, is given in Table 1.

Students who had used the selected slides in the Industrial Electricity, Automotive, and Machine Shop areas were tested in the comprehensive high schools, in the area vocational-technical schools, and in the skills centers. Nurse's Aide students were tested only in the occupational school for Educable Mentally Retarded (EMR) students, where 10 students completed all of the required slide units, and all of them passed the criterion test. Because of time restrictions and problems with equipment in the shops not matching that shown in the units, the number of students who actually completed all of the slide units by the time testing was scheduled to start was rather small. There were, in addition, some special problems that should be mentioned before attempting to interpret the data presented in Table 1.

At the skills center, two automotive teachers agreed to participate in the project by using only the PIVOT materials with their students to teach the material on which the criterion task was to be based. They indicated to the project staff that they would be able to supply approximately 13 students for testing by the end of the school year. Unfortunately, the only automobile engine suitable for use with the criterion test became inoperative before testing could begin, and testing had to be postponed until June 11, 1976. By that time, however, only two students were still available for testing, because most of the students in the classes

came to the skills center from various parochial schools and these schools no longer required attendance at the skills center by June 11th. One of the tested students was, in fact, from a parochial school. He was present voluntarily, as a favor, so that he could be tested. Because of the unusual circumstances surrounding the testing the Automotive area at the skills center, therefore, the results shown in Table 1 for that area should not be considered any fair indication of the effectiveness of the PIVOT materials in the skills centers.

Another setting in which a serious problem developed at the time testing was to start was in the Automotive class in the area vocational-technical school (Group 5 in Table 1). Students in this class had been trained to do the work required for the criterion task using an engine like the one shown in the slide units. At the time of testing, however, the engine used with the slide units was not working. Since the test required an engine capable of being started, the teacher provided a different engine for the test, which he thought would be suitable, but which the consultants agreed presented the students with a challenge entirely out of proprotion to the original intent of the test. Some of the students were able to do the task successfully, but the fact that nine of the 13 failed the test was, in the opinion of the consultants, a result of the substitution of a new type of engine, and not a reflection on the effectiveness of the PIVOT units.

TABLE 1

Numbers of Students Instructed by the PIVOT Method Passed and Failed on the Criterion Task in Each Setting

Group Number	Subject Area	Type of School	Number of Experimental Students (PIVOT Method)	Number Passed	Number Failed
1	Industrial Electricity	Comprehensive High School	6	3	3
2	Automotive	Comprehensive High School	6	4	2
3	Machine Shop	Comprehensive High School	8	5	3
4	Industrial Electricity	Area Vocational-Technical School (AVTS)	13	7	6
5	Automotive	AVTS	13	4	9
6	Machine Shop	AVTS	5	3	2
7	Nurse's Aide (EMR Students)	Occupational School	10	10	0
8	Industrial Electricity	Skills Center	5	4	1
9	Automotive	Skills Center	2	0	2
10	Machine Shop	Skills Center	4	4	0

The Industrial Electricity teacher in the comprehensive high school (Group 1 in Table 1) had a great deal of difficulty in obtaining equipment similar to that shown in the slide units. By the time it was possible to provide him with equipment that the students could use on their own, following the directions in the slide units, most of the available teaching time had elapsed. This helps to explain not only the size of the group available for testing, but also the fact that a smaller proportion of these students passed the criterion test than in any other setting that could be considered at all a reasonable test of the PIVOT method.

In all of the groups, of course, the number of students tested was quite small, due mainly to the limited time available for instruction and the fact that most teachers could set up only two or three work stations in their shops on such short notice. The universality of any conclusions drawn from samples of this size must therefore be regarded with great caution, but it is encouraging to note that most students tested were able to perform the criterion tasks well enough to be said to have achieved "entry level" competency in their area. Significantly, all 10 of the Nurse's Aide (EMR) students passed the criterion test. Since the PIVOT materials are designed to be used with a wide variety of students, including those with reading difficulties, this is an indication that they will indeed function appropriately with students at the lower levels of the academic spectrum.

Objective 2

> To determine whether students will be able to demonstrate proficiency equal to or greater than comparable students in a variety of educational settings, i.e., comprehensive high schools, area vocational-technical schools, skills centers, and occupational centers, after having completed training in the same skills under different educational methodology, i.e., PIVOT as opposed to traditional classfront instruction.

To compare the effectiveness of the PIVOT method of instruction to the effectiveness of traditional methods of teaching the same subject matter, it was necessary to have control classes which were taught the same subject matter as that presented in the slide units, but by the usual, classfront methods. This was possible in all of the settings shown in Table 1 except for Groups 8, 9, and 10, in the skills center, because no traditional instructional setting existed in Philadelphia that was organized like a skills center.

For each of the subjects and settings listed in Table 1 (Groups 1 to 7) a control class was taught the same subject matter by traditional methods. In all cases except Nurse's Aide in the occupational school, the control class was located in a different school from the experimental class, to minimize the possible effect of cross-contamination between the two methods of instruction. In the case of the EMR students, however, it was considered desirable to use two

classes in the same school, so that the experimental and control students would be as similar as possible.

Table 2 shows the number of students who passed and failed the criterion tests in both the experimental and control classes in all settings and subject areas involved in the experiment.

TABLE 2

Criterion Test Performance of All Experimental and Control Subjects

Subject Areas & Treatment Groups	Number Passed	Number Failed
Comprehensive High Schools:		
(1) Industrial Electricity		
Experimental Group:	3	3
Control Group:	8	1
(2) Automotive		
Experimental Group:	4	2
Control Group:	1	6
(3) Machine Shop		
Experimental Group:	5	3
Control Group:	10	2
Area Vocational-Technical Schools:		
(4) Industrial Electricity		
Experimental Group:	7	6
Control Group:	9	1
(5) Automotive		
Experimental Group:	4	9
Control Group:	12	4
(6) Machine Shop		
Experimental Group:	3	2
Control Group:	7	0
Occupational School:		
(7) Nurse's Aide (EMR)		
Experimental Group:	10	0
Control Group:	3	3

According to the proposal, the data presented in Table 2 were to be analyzed by means of a three-way Chi-square design, with the three variables identified as number of students passing and failing; type of treatment (experimental or control); and category of reading level (1st to 15th percentile, 16th to 49th percentile, and 50th percentile and above) on the California Achievement Test. Unfortunately, when the expected frequencies in each of the 12 cells of this 2 x 2 x 3 Chi-square design were calculated for each of the first six groups in Table 2, they were found to be too small to allow the use of the Chi-square test with these data, according to the criteria given by Siegel.[1]

Combining adjacent categories, as recommended by Siegel,[2] was possible only with the reading scores. After combining the upper two levels of reading scores, the expected frequencies in the eight cells of the resulting 2 x 2 x 2 design still did not meet the criteria for use of the Chi-square test. The seventh group, consisting entirely of EMR students, did not have California Achievement Test reading scores on file. Their data were supposed to have been analyzed by means of a 2 x 2 Chi-square design (Pass/Fail vs. Treatment). Unfortunately, the total number of students (16) in that group also did not meet Siegel's criteria for the use of the Chi-square test. Since no meaningful Chi-square tests could be done in the way specified in the proposal, the data from Table 2 were analyzed by the Fisher Exact Probability Test, as recommended by Siegel.[3]

To use the Fisher Exact Probability Test, which is applicable to 2 x 2 tables, the reading scores in each of the first six groups in Table 2 were not considered, and the data were analyzed in the same form as shown in the table (Pass/Fail vs. Treatment). For Group 5 (Automotive in the area vocational-technical schools), the number of subjects in the resulting 2 x 2 contingency table was sufficient for the use of a Chi-square test, but the experimental conditions had been such that the data for that group were not considered valid (see discussion in this section under Objective 1, pp. 11). Therefore, no statistical test was performed for that group.

The data from all the other groups in Table 2 were suitable for the Fisher Exact Probability Test. The tests showed no significant interactions at the 0.05 significance level for any group except Group 7, EMR students taking the Nurse's Aide course. Significantly more students passed the Nurse's Aide criterion test after having been instructed by the PIVOT method than after having been instructed by the conventional method.

Except in the case of the Nurse's Aide students, where a significant difference was found, it is not possible to say whether the lack

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[1] Siegel, Sidney, Nonparametric Statistics for the Behavioral Sciences, p. 110.

[2] Ibid.

[3] Ibid., pp. 96 - 104

of significant differences between the two methods of instruction was due to equivalence of the two methods if instruction or to the small sample sizes. The size of the samples, however, is probably the most important factor. Repetition of the experiment with larger groups of students would make possible a more definite answer in relation to this objective.

Objective 3

To determine whether the ability of students to develop proficiency in job skills by using the PIVOT system is related to student academic achievement.

For this objective, 2 x 2 contingency tables were set up relating the number of students passing and failing with the PIVOT method in each of the first six groups in Table 2 to their California Achievement Test reading scores (divided into two categories: 1st to 15th percentile and 16th percentile and above). Since none of these tables had enough cases to justify the use of a Chi-square test, the Fisher Exact Probability Test was used for all of them.

The results of the Fisher tests were uniformly non-significant. That is, for all of the first six groups in Table 2, no significant relationship could be found between reading ability and success or failure with the PIVOT instructional method. Whether this is due to the absence of a relationship or to the very small smaple size cannot be answered on the basis of the present data. Only repetition of the experiment with larger numbers of students would permit that distinction to be made. Verification of the absence of a relationship, with sufficiently large groups of students to eliminate the question of sample size as a factor in the results would, of course, indicate the usefulness of the PIVOT system with all types of students, including those with reading difficulties.

Objective 4

To determine whether Educable Mentally Retarded (EMR) students are able to develop proficiency in job skills using the PIVOT system.

The question posed by this objective was adequately answered by the fact that all 10 of the EMR students instructed by the PIVOT method in the Nurse's Aide course passed the criterion test at the end of the year. While this is, of course, a sample of only one subject area, with a small number of students, Nurse's Aide is one of the subjects in which many EMR students are trained. The teacher expressed considerable satisfaction with the use of the PIVOT system in her class. She noted that the students seemed eager to use the sound-on-slide projectors, and were motivated perhaps as much by the format in which the subject matter was being presented as by the content. There is every reason to think on the basis of the limited experience with EMR students in the present study, that the use of the PIVOT method with such students may be quite effective, and that its use with them should be studied on a larger scale.

Objective 5

To determine whether bilingual (Spanish-English speaking) students are able to develop proficiency in job skills using the PIVOT system.

As discussed under "Procedures," (see pp. 8 - 9,)the data needed for a discussion of the effectiveness of the PIVOT method with bilingual (Spanish-English speaking) students could not be obtained. It was not possible, therefore, to address this objective.

Questionnaire Results

During the experiment, questionnaires were completed by the teachers of the experimental and control classes, and by the teachers at the Randolph Skills Center who had used the PIVOT materials during the year. The industrial and school district consultants also completed questionnaires at the end of the testing period, concerning their perceptions of the PIVOT system. In this section, a summary is presented of those questionnaire results that are relevant to the overall experimental findings. A summary of all questionnaire responses and copies of the actual instruments will be found in Appendix G.

Questionnaires completed in March by both the experimental and control teachers were mainly for the purpose of obtaining background information about the participating classes, and data needed to facilitate arrangements for the criterion testing in May and June. Some of the answers, however, may be of value in understanding the significance of the experimental results.

In answer to a question about whether or not the tasks taught for the PIVOT project were normally a part of their curriculum, 91% of the experimental teachers and 86% of the control teachers said that all or most of the tasks were normally a part of their curriculum. All of the experimental and control teachers responded that they did not consider the tasks too difficult for their classes. Six of the seven control teachers and eight of the eleven experimental teachers said that they had the materials necessary to teach the tasks designated for their classes; efforts were started to supply the rest of the teachers with the materials they required.

At the end of April, 1976, before testing of their students began, the experimental teachers completed a questionnaire concerning their experiences during the project with the PIVOT materials. These responses covered a broad range of areas which should be of interest to future users of the PIVOT system. Also, some of the answers were of value in understanding the outcome of the present experiment. Ten of the eleven teachers thought it was "extremely important" that the equipment shown in the PIVOT slides " exactly match" the equipment in the shop where they will be used, and the eleventh teacher responded that it was "important." In answer to other questions, however, five teachers said they had "difficulties" in implementing the PIVOT system in their shops, and four said the sound-on-slide

units did not fit the conditions and materials in their shops. Three of the teachers with difficulties in setting up the PIVOT system attributed them to a mismatch between their shop equipment and the equipment shown in the slides, while the other two said that the layout of their shop did not make it convenient to install the sound-on-slide projectors.

It is a point in favor of the PIVOT method that in spite of the implementation problems in this experiment the teachers who used the method were generally favorably impressed by it, even if it did not achieve its full potential in their particular classrooms. Eighty-two percent of the experimental teachers said they thought the units they had used were "very effective" or "effective" in teaching the material contained in them, and 73% said they would be "very enthusiastic" or "enthusiastic" about using the PIVOT method instead of the method they ordinarily used to teach the same material. All 11 teachers said that their students were generally able to understand the material in the units. All 11, however, also said that the PIVOT method is "definitely" (73%) or "probably" (27%) best used as an aid to conventional instruction, indicating that they were not entirely pleased with the idea of using PIVOT exclusively. Exclusive use of PIVOT is not, however, its intended role, so that this preference for using it as an aid is not inconsistent with the applications planned for it.

On the basis of the April, 1976, questionnaires, it can be said that the experimental teachers found the units to be well suited to their intended purpose, not difficult to use, but in some cases poorly matched to the equipment in their shops. While this last problem could be remedied easily in ordinary classroom use of PIVOT, it was not possible to remedy it in all cases in the present experiment.

The greatest use of the PIVOT materials to date has been in the Randolph Skills Center, which opened in September, 1975. In order to obtain more information about use of the PIVOT materials in a skills center, a questionnaire was completed in April, 1976 by the teachers at the skills center who had access to PIVOT materials during the 1975-76 school year. It should be noted that this was the first year of operation of the first skills center in Philadelphia, and that use of the PIVOT materials was not the first priority of the staff, with matters such as setting up the shop facilities naturally taking precedence. Still, the observations of the faculty about the PIVOT materials will be of interest to future users of the system, who will be in the same situation as these teachers were, when they first attempt to implement the PIVOT system.

Of the 39 teachers at the skills center, 25 said they had used the PIVOT method in class for at least part of the year. They estimated that the percentage of their curriculum for which they had PIVOT units available ranged from 0.25% to 90% with a mean of 33.8%, and the percentage of class time during which the units were in use ranged from 0.5% to 70%, with a mean of 22.5%. When asked the main use to which they had put the sound-on-slide units this year, 64% of the teachers chose "Initial instruction in an area,

with individual students, "while an additional 16% chose "Review of previously taught material, with individual students." Thus, 80% of the teachers said they were using the PIVOT materials mainly for individualized instruction, which was the main purpose for which they were designed.

In a response pattern quite similar to that of the experimental teachers, 92% of the skills center teachers rated the units they had as either "very effective" or "effective" in teaching the material they covered; 88% said they would be either "very enthusiastic" or "enthusiastic" about using the PIVOT method rather than their ordinary method to teach the same material; and 92% said their students were generally able to understand the material in the units.

One interesting difference between the responses at the skills center and among the experimental teachers was that while no experimental teachers expressed a need for more staff development time in order to be able to use the sound-on-slide system more effectively, 72% of the skills center teachers said that they felt such a need. Four skills center teachers noted that they lacked equipment shown in the slide units, but expected to receive it at a later date, so that this was not the same as the type of mismatching of equipment and slides that took place in some experimental classes.

Among the skills center teachers, as among the experimental teachers, there was a generally optimistic response pattern concerning the value of the PIVOT system. A detailed reading of the actual questionnaire responses (see Appendix G) will allow potential users of the system to anticipate problems they may encounter. In general, however, these problems do not relate to the utility of the system, but to matters that will become progressively less serious as the teachers and students become more familiar with it.

After all of the criterion tests were completed, the four school district consultants and the four industrial consultants were asked to complete an essay-type questionnaire concerning their perceptions of the PIVOT system. Their opinions did not differ markedly from those of the teachers who had used the system. They generally felt that the PIVOT system was of great potential value as a teaching method, although not as the sole means of instruction. Some mentioned the urgent need that the slides exactly match the equipment in the shop. This requirement was the least flexible aspect of the PIVOT system as used in this experiment. Compensating for mismatching of the equipment in the shop and on the slides placed an extra burden on the students that would have been possible to avoid in ordinary classroom situations. The specificity of the slides in the Automotive area, for example, resulted in comments from both consultants in that area to the effect that the content of the slide units would not be of value to a student dealing with a different make of car or even a different engine. This is in agreement with the teachers' perceptions of their problems in implementing the PIVOT system, the most serious of which were those connected with lack of equipment like that shown in the slide units.

CONCLUSIONS AND RECOMMENDATIONS

On the basis of the data presented in the preceding section, there is no doubt that students trained by the PIVOT system were capable of successfully performing the criterion tasks. Inspection of the tables shows that there were students in every setting and subject area who were able to learn to do the criterion tasks by using the PIVOT materials. In the Nurse's Aide area of instruction none of the ten EMR students trained by the PIVOT method failed the criterion test, which is certainly an encouraging outcome for the feasibility study with those students.

Determination of the relative effectiveness of the PIVOT and conventional methods of instruction required the testing of sufficient numbers of students to allow the Chi-square or Fisher tests to show significant results. Although the proportions of students passing and failing differed between the experimental and control settings, the absolute numbers of students involved were too small to allow any statements to be made about the significance of most of these observed variations. The notable exception to this was the Nurse's Aide experiment, in which the EMR students instructed by the PIVOT method did significantly better on the criterion test than those instructed by the conventional method.

It was not possible on the basis of the experimental data to draw any conclusions about the effect of academic achievement (as measured by reading scores) on potential for success with the PIVOT method. The use of larger groups of students might have made it possible to identify such an interaction, but it was not detected in the present study.

Repetition of the experiment with larger groups of students and with more time to use the sound-on-slide equipment in class will be necessary to produce valid information about the relative effectiveness of the PIVOT and conventional methods of instruction. The effect of reading ability on the effectiveness of the PIVOT method, if such an effect exists, can also be determined only by means of an experiment involving larger numbers of students. Also, the experiment should be repeated under more controlled conditions, especially in terms of matching the equipment in the shops to that shown in the slide units.

Recommendations can be made concerning the problems likely to be encountered in the implementation of the PIVOT system in a new setting. It will be possible in ordinary classroom use to overcome many of the difficulties with mismatching of equipment that were encountered in this experiment, simply by altering the slide units in straightforward ways that have already been developed by the PIVOT curriculum writers, although these methods could not be applied to the present experimental conditions. Responses of the teachers in the skills center indicated an optimistic feeling about the sound-on-slide system of instruction, but also a need for more staff development time concerning its use in class. Therefore, adequate staff development, including instruction in how to make minor repairs and adjustments to the projectors, should be given a high priority when the system if first introduced.

Some teachers suggested that headphones were of value in quiet shops where the sound of the recordings might disturb other students, while others suggested that headphones were of value in noisy shops, to shut out the background noise. Thus, the provision of headphones with the projectors (which have a jack for them) should certainly be considered seriously when the system is installed. They were used in a few shops during this project, with favorable results, although they may limit the mobility of the students, if they are working on large machines or on anything requiring walking around. Also, the safety factor of a dangling headphone cord is a major consideration around moving machinery, such as lathes or milling machines.

In any experiment involving testing of a particular teacher's classes, even when there is a guarantee of anonymity, teachers may feel that their personal effectiveness is in question, particularly if they begin to suspect that their students will not do well on tests that are part of the experiment. In addition to reassuring the staff that this is not the case, an additional technique that might prove beneficial would be to use the same teachers to teach both the experimental and control classes, during different periods during the day. This would help to minimize the effect of teacher competence on the experimental results, and would make it obvious that differences in test performance were due to the method of instruction or the students, but not very likely to the teachers. It would also double the number of students taught by each teacher, and thereby have a beneficial effect on sample size.

In spite of the rather unfortunate circumstances under which it was implemented, PIVOT succeeded in developing entry-level competency in students in every setting. The success rate with EMR students was significantly higher with the PIVOT method than with the control method.

Some specific recommendations can be made concerning problems encountered in the present study which can be eliminated or minimized in future studies. The small sample sizes can be increased by using more classes per subject area in each setting, and by allowing more time for the instructional units to be used in class, thereby allowing more students to complete them. Teaching with the sound-on-slide units should begin in September, which will help to insure that the students have little opportunity to learn the material in the units from any other sources. It will also provide the maximum amount of instructional time before testing is started. Slide units to be used in the experiment should, therefore, be on topics suitable for use at the start of a school year.

Assuming that alteration of the slide units to fit individual shops will be undesirable in an experimental situation, because all experimental subjects should be exposed to the same treatment, units to be used should be selected so that all of the teachers have equipment in their shops identical to that shown in the units. This fact should be verified by on-site inspection before the experiment begins. Sufficient preparation time should be provided (during the preceding spring term) for selection of teachers and classes, for setting up of work stations in the shops, and for

staff development sessions to prepare the teachers for participation in the experiment. Examination of the slide units by outside consultants should take place before the start of the experiment, so that any defects that they detect can be corrected before the units are replicated for use in the experimental classes.

Appendix A

Schedule of Staff Development Meetings

Staff Development Meetings

Date	Participants	Purpose of Meeting
10/21/75	All project personnel, including teachers and administrators	Explanation of the purpose of the experiment, methodology, answering of questions about the experiment, and agreement by the teachers on the subject matter they would all be able to teach.
11/25/75	Experimental (PIVOT) teachers	Detailed familiarization of the experimental teachers with the exact content of the slide units they would be using, use of printed materials, and practice in the use of the sound-on-slide projectors.
12/11/75	Control teachers	Familiarization of the control teachers with the exact content of the PIVOT units, so they would know what they were to teach (in their own way).
1/13/76	Experimental teachers	Discussion with personnel experienced in the use of PIVOT materials of ways of setting up work stations in shops. More practice in use of the projectors and discussion of classroom management problems related to implementation of the PIVOT system.
2/19/76	Experimental teachers	Instruction in techniques for making simple repairs in the field on sound-on-slide projectors.
3/16/76	Control teachers	Planning of testing schedule and dicussion of any problems they were having in teaching the required subject matter.
3/25/76	Experimental teachers	Planning of testing schedule and discussion of problems they were having in teaching with the PIVOT materials.
4/27/76	Experimental teachers	Discussion of their perceptions of the PIVOT system and final settlement of testing schedule for May and June.

Appendix B

Lists of PIVOT Units From Which Teachers

Selected Those To Be Used In The Experiment

INDUSTRIAL ELECTRICITY

Task #1 Install A Twist Type Solderless Connector
Unit of Operation A.

Task #2 Install A Set Screw Type Solderless Connector
Unit of Operation A.

Task #3 Install A Solderless Terminal on a Wire
Unit of Operation A.

Task #4 Wire A Three Wire Grounded Plug
Unit of Operation A.

Task #5 Wire a Three Wire Grounded Cord Connector
Unit of Operation A.

Task #6 Punch a Hole for Half Inch Electrical Fitting
Unit of Operation A.

Task #7 Punch a Half Inch Knockout Hole to a Larger Size
Unit of Operation A.

Task #8 Check for Line Voltage in a Fuse Panel with a Neon Tester
Unit of Operation A.

Task #9 Check the Main Fuses in a Fuse Panel with a Neon Tester
Unit of Operation A.

Task #10 Check the Range Fuses in a Fuse Panel with a Neon Tester
Unit of Operation A.

Task #11 Check the Plug Fuses in a Fuse Panel with a Neon Tester
Unit of Operation A.

Task #12 Replace Defective Cartridge Fuses in a Fuse Panel Pull Out
Unit of Operation A.

Task #13 Replace Defective Plug Fuses in a Fuse Panel
Unit of Operation A.

Task #14 Check Plug Fuses with a Continuity Tester
Unit of Operation A.

Task #15 Check Cartridge Fuses with a Continuity Tester
Unit of Operation A.

Task #16 Install Cartridge Fuses in a Safety Switch
Unit of Operation A.

Task #17 Reset A Tripped Circuit Breaker
Unit of Operation A.

Task #18 Check A Fuse with an Ohmmeter
Unit of Operation A.

Task #19 Check A Fuse with a Voltmeter
Unit of Operation A.

Task #20 Replace A Burnt Out Fuse Link
Unit of Operation A.

Task #21 Test Insulation Resistance of a Motor with a Megger
Unit of Operation A.

Task #22 Mark A Motor for Disassembly
Unit of Operation A.

Task #23 Mark A Motor Mount for Disassembly
Unit of Operation A.

Task #24 Remove A Motor from its Mount
Unit of Operation A.

Task #25 Disassemble A Motor
Unit of Operation A.

Task #26 Air Clean A Disassembled Motor
Unit of Operation A.

Task #27 Remove A Defective Ball Bearing From A Rotor
Unit of Operation A.

Task #28 Install A Ball Bearing on a Rotor
Unit of Operation A.

Task #29 Check A Motor Starter with a Growler
Unit of Operation A.

Task #30 Check A Motor Rotor with a Growler
Unit of Operation A.

Task #31 Reassemble A Motor
Unit of Operation A.

Task #32 Replace A Motor in its Mount
Unit of Operation A.

Task #33 Replace Brushes in a Motor
Unit of Operation A.

Task #34 Check the Speed of a Motor
Unit of Operation A.

Task #35 Remove A Set Screw Type Pulley From a Motor
Unit of Operation A.

Task #36 Install A Set Screw Type Pulley on a Motor
Unit of Operation A.

Task #37 Remove A Key Way Type Pulley From a Motor
Unit of Operation A.

Task #38 Install A Key Way Type Pulley on a Motor
Unit of Operation A.

Task #39 Connect A Dual Voltage Repulsion Motor for Low Voltage
Unit of Operation A.

Task #40 Connect A Dual Voltage Repulsion Motor for High Voltage
Unit of Operation A.

Task #41 Connect A Dual Voltage Capacitor Motor for Low Voltage
Unit of Operation A.

Task #42 Connect A Dual Voltage Capacitor Motor for High Voltage
Unit of Operation A.

Task #43 Connect A Three Phase "Y" Connected Motor for Low Voltage
Unit of Operation A.

Task #44 Connect A Three Phase "Y" Connected Motor for High Voltage
Unit of Operation A.

Task #45 Connect A Dual Voltage Two Phase Motor for Low Voltage
Unit of Operation A.

Task #46 Connect A Dual Voltage Two Phase Motor for High Voltage
Unit of Operation A.

Task #47 Reverse A Repulsion Motor
Unit of Operation A.

Task #48 Reverse A Three Phase Motor
Unit of Operation A.

Task #49 Reverse A Split Phase Motor
Unit of Operation A.

Task #50 Reverse A Capacitor Motor
Unit of Operation A.

Task #51 Reverse A Two Phase Motor
Unit of Operation A.

Task #52 Replace A Defective Single Pole Manual Motor Starter
Unit of Operation A.

Task #53 Replace A Defective Limit Switch
Unit of Operation A.

Task #54 Replace A Defective Hand-Off-Auto Switch
Unit of Operation A.

Task #55 Replace A Defective Drum Reversing Switch
Unit of Operation A.

Task #56 Replace A Defective Three Phase Manual Motor Starter
Unit of Operation A.

Task #57 Replace A Defective Three Phase Across-The-Line Starter
Unit of Operation A.

Task #58 Replace A Defective Control Contacts in an Across-The-Line Starter
Unit of Operation A.

Task #59 Replace Defective Power Contacts in an Across-The-Line Starter
Unit of Operation A.

Task #60 Replace A Defective Control Coil in an Across-The-Line Starter

Task #61 Replace A Defective Overload Relay in an Across-The-Line Starter

Task #62 Install an Overload Heater in a Manual Motor Starter
Unit of Operation A.

Task #63 Wire A Limit Switch to an Across-The-Line Starter
Unit of Operation A.

Task #64 Wire A Stop-Start Pushbutton Station to an Across-The-Line Starter
Unit of Operation A.

Task #65 Measure Motor Starting Current with a "Snap-On" Volt-Amp-Ohm Meter
Unit of Operation A.

Task #66 Measure Motor Running Current With a "Snap-On" Volt-Amp-Ohm Meter
Unit of Operation A.

Task #67 Measure Line Voltage Current With a "Snap-On" Volt-Amp-Ohm Meter
Unit of Operation A.

Task #68 Test A Motor for Grounds with a Snap-On Volt-Amp-Ohm Meter
Unit of Operation A.

Task #69 Operate A Two Wire Control Circuit
Unit of Operation

Task #70 Operate A Three Wire Control Circuit
Unit of Operation

Task #71 Troubleshoot A Two Wire Control Wire
Unit of Operation A.

Task #72 Troubleshoot A Three Wire Control Circuit
Unit of Operation A.

Task #73 Troubleshoot The Power Circuit of an Across-The-Line Starter

Task #74 Troubleshoot The Control Circuit of an Across-The-Line Starter
Unit of Operation A.

AUTOMOTIVE

Task #1 Clean the Idle Circuit on a Rochester Single Barrel Carburetor
Unit of Operation
A. Disassembling the Idle Circuit
B. Air Cleaning the Idle Circuit
C. Re-Assembling the Idle Circuit

Task #2 Clean the Accelerator Pump Circuit on a Single Barrel Rochester Carburetor
Unit of Operation A.

Task #3 Replace the Needle Valve and Seat on a Rochester Single Barrel Carburetor
Unit of Operation A.

Task #4 Replace the Accelerator Pump Plunger on a Single Barrel Rochester Carburetor
Unit of Operation A.

Task #5 Clean The Power Valve and Power Piston on a Rochester Single Barrel Carburetor
Unit of Operation A.

Task #6 Replace the Fuel Filter on a Rochester Single Barrel Carburetor
Unit of Operation A.

Task #7 Clean the Idle Circuit on a Two Barrel Rochester Carburetor
Unit of Operation
A. Removing the Air Horn Assembly
B. Removing the Throttle Assembly
C. Air Cleaning the Idle Circuit
D. Replacing the Throttle Body Assembly
E. Replacing the Air Horn Assembly

Task #8 Clean the Accelerator Pump Circuit on a Two Barrel Rochester Carburetor
Unit of Operation
A. Disassembling and Cleaning the Accelerator Pump Circuit
B. Reassembling the Accelerator Pump Circuit

Task #9 Service the Power Valve and Main Metering Jets on a Two Barrel Rochester Carburetor
Unit of Operation A.

Task #10 Replace the Needle Valve and Seat on a Rochester Two Barrel Carburetor
Unit of Operation A.

Task #11 Clean the Choke Assembly on a Two Barrel Rochester Carburetor
Unit of Operation A.

Task #12 Clean the Idle Compensator Valve on a Two Barrel Rochester Carburetor
Unit of Operation A.

Task #13 Replace the Accelerator Pump Plunger on a Two Barrel Rochester Carburetor
Unit of Operation A.

Task #14 Clean the Idle Circuit on a Rochester Four Barrel Carburetor
Unit of Operation
- A. Removing the Air Horn Assembly
- B. Removing the Throttle Body Assembly
- C. Air Cleaning the Idle Circuit
- D. Replacing the Throttle Assembly
- E. Replacing the Air Horn Assembly

Task #15 Clean the Accelerator Pump Circuit on a Four Barrel Rochester Carburetor
Unit of Operation
- A. Disassembling and Cleaning the Accelerator Pump Circuit
- B. Reassembling the Accelerator Pump Circuit

Task #16 Replace the Accelerator Pump Plunger on a Four Barrel Rochester Carburetor
Unit of Operation A.

Task #17 Replace the Needle Valves and Seats on a Four Barrel Rochester Carburetor
Unit of Operation A.

Task #18 Service the Power Valve and Main Metering Jets on a Four Barrel Rochester Carburetor
Unit of Operation A.

Task #19 Clean High Tension Ignition Wires and Towers
Unit of Operation A.

Task #20 Connect and Operate a Remote Control Starter Switch
Unit of Operation A.

Task #21 Connect and Operate a Timing Light
Unit of Operation A.

Task #22 Replace Ignition Wires
Unit of Operation A.

Task #23 Make a Spark Plug Wire
Unit of Operation A.

Task #24 Check the Resistance of Spark Plug Wires
Unit of Operation A.

Task #25 Locate and Mark Ignition Timing Marks
Unit of Operation

Task #26 Remove and Install a Distributor in an Engine Mounted on an Engine Stand

Unit of Operation
A. Removing a Distributor from an Engine
B. Installing a Distributor in an Engine

Task #27 Locate Number One Firing Position with the Distributor Removed

Unit of Operation A.

MACHINE SHOP

Task #1 Drill and Countersink A Hole
Unit of Operation
A. Laying Out For a Hole
B. Mounting The Work and Drill
C. Drill the Hole
D. Mounting a Countersink
E. Countersinking the Hole
F. Breaking Down and Cleaning Up

Task #2 Drill A Blind Hole
Unit of Operation
A. Laying Out For a Blind Hole
B. Mounting and Centerdrill and Workpiece
C. Centerdrilling a Hole
D. Mounting a Taper Shank Drill
E. Clamping A Drill Press Vise
F. Setting the Stop For A 1/2" Deep Hole
G. Drilling A Blind Hole
H. Breaking Down and Cleaning Up

Task #3 Spotface Two Holes On A Casting on the Drill Press
Unit of Operation
A. Laying Out the Holes on A Casting
B. Mounting the Work and Drill
C. Drilling Two Holes in a Casting
D. Mounting the Spotface
E. Spotfacing Two Holes
F. Breaking Down and Cleaning Up

Task #4 Counterboring A Hole On A Drill Press
Unit of Operation
A. Laying Out A Hole for Counterboring
B. Mounting the Drill and Workpiece
C. Drilling A Hole
D. Mounting the Counterbore
E. Setting the Stop for a 5/16" Deep Hole
F. Counterboring A Hole
G. Breaking Down and Cleaning Up

Task #5 Centerdrilling Round Stock on a Drill Press
Unit of Operation
A. Laying Out the End of Stock
B. Mounting the Centerdrill and Workpiece
C. Centerdrilling A Hole in Round Stock
D. Breaking Down and Cleaning Up

Task #6 Reaming on a Lathe
Unit of Operation
A. Mounting the Work in A Three Jaw Chuck
B. Mounting A Reamer in the Tailstock
C. Starting the Lathe
D. Reaming on a Lathe
E. Breaking Down and Cleaning Up

Task #7 Reading a Micrometer
Unit of Operation
A. Cleaning and Checking A Micrometer
B. Reading a Micrometer Scale
C. Taking Measurements with a Micrometer

Task #8 Use A Screwdriver
Unit of Operation
A. Using Screwdrivers - Disassembly
B. Using Screwdrivers - Assembly

Task #9 Centerdrill on A Lathe
Unit of Operation
A. Mounting A Three Jaw Chuck
B. Removing A Three Jaw Chuck

Task #10 Turn on a Lathe Between Centers
Unit of Operation
A. Mounting A Face Plate and Live Center
B. Setting the Feed For Turning

Task #11 Facing on a Lathe
Unit of Operation
A. Setting the Feed For Facing

Task #12 Setting Up Round Material in the Vise on a Horizontal Milling Machine
Unit of Operation
A. Mounting an Arbor on a Horizontal Milling Machine
B. Mounting A Cutter on a Horizontal Milling Machine
C. Mounting an Arbor Support on a Horizontal Milling Machine
D. Mounting a Vise on a Horizontal Milling Machine

Task #13 Set the Feed and Speed for Cutting a Flat Surface on Round Material-Starting and Stopping a Horizontal Milling Machine
Unit of Operation
A. Setting the Speed and Feed on a Horizontal Milling Machine
B. Starting and Stopping a Horizontal Milling Machine

Task #14 Milling a Flat Surface on Round Stock with a Milling Machine
Unit of Operation
A. Taking a Trial Cut on a Horizontal Milling Machine
B. Making the First Cut in a Horizontal Milling Machine
C. Making the Second Cut on a Horizontal Milling Machine

Task #15 Breakdown of a Horizontal Milling Machine After Completing the Flat Cut on Round Material
Unit of Operation
A. Removing the Workpiece from the Horizontal Milling Machine
B. Removing the Cutter from a Horizontal Milling Machine
C. Removing the Arbor from a Horizontal Milling Machine

Task #16 Final Breakdown and Clean Up of a Horizontal Milling Machine after Completing the Flat Cut on Round Material

Unit of Operation
A. Breakdown and Clean Up of a Horizontal Milling Machine

Task #17 Set Up Flat Material in a Vise on a Horizontal Milling Machine for Cutting a Slot

Unit of Operation
A. Mounting a 3/8" by Diameter Cutter on a Horizontal Milling Machine
B. Mounting an Arbor Support on a Horizontal Milling Machine
C. Mounting the Workpiece on a Horizontal Milling Machine

Task #18 Set the Feed and Speed for Cutting a Slot in Flat Material: Start and Stop a Horizontal Milling Machine

Unit of Operation
A. Setting the Feed and Speed on a Horizontal Milling Machine
B. Starting and Stopping a Horizontal Milling Machine
C. Making the Second Cut on a Horizontal Milling Machine

Task #19 Mill A Slot in Flat Material with a Horizontal Milling Machine

Unit of Operation
A. Taking a Trial Cut on a Horizontal Milling Machine
B. Making the First Cut on a Horizontal Milling Machine
C. Making the Second Cut on a Horizontal Milling Machine

Task #20 Breakdown and Cleanup of a Horizontal Milling Machine after Completing the Slot Cut on a Horizontal Milling Machine

Unit of Operation
A. Removing the Workpiece from a Horizontal Milling Machine
B. Removing the Cutter and Clean Up of a Horizontal Milling Machine

Task #21 Set Up Round Material in a Vise on a Vertical Milling Machine to Cut a Flat Surface

Unit of Operation
A. Mounting a Collet and Cutter on a Vertical Milling Machine
B. Mounting a Vise on a Vertical Milling Machine
C. Mounting a Workpiece of a Vertical Milling Machine

Task #22 Set the Spindle Speed for Cutting a Flat Surface on Round Material: Start and Stop a Vertical Milling Machine

Unit of Operation
A. Setting the Spindle Speed on a Vertical Milling Machine
B. Starting and Stopping a Vertical Milling Machine

Task #23 Mill a Flat Surface on Round Material with a Vertical Milling Machine

Unit of Operation
- A. Taking a Trial Cut on a Vertical Milling Machine
- B. Making the First Cut on a Vertical Milling Machine
- C. Making the Second Cut on a Vertical Milling Machine

Task #24 Breakdown of a Vertical Milling Machine after Completing the Flat Cut on Round Material

Unit of Operation
- A. Removing the Workpiece from a Vertical Milling Machine
- B. Removing the Cutter and Collet from a Vertical Milling Machine

Task #25 Final Breakdown and Clean Up of a Vertical Milling Machine after Completing the Flat Cut on Round Material

Unit of Operation
- A. Breakdown and Clean Up of a Vertical Milling Machine

DRAFTING

Task #1 Draw the Border and Title Block on the Paper
Unit of Operation A.

Task #2 Draw the Front and Right Side Views
Unit of Operation
- A. Drawing the Border and Title Block on the Paper
- B. Blocking in the Front and Right Side Views
- C. Drawing Vertical Lines for Cut-outs in the Front and Right Side Views
- D. Drawing the Horizontal Lines for Cut-outs in the Front and Right Side Views
- E. Drawing Lines for Details in the Front and Right Side Views
- F. Heavying-in all Lines in the Front and Right Side Views

Task #3 Draw the Top and Front Views
Unit of Operation
- A. Drawing the Border and Title Block in the Paper
- B. Blocking-in the Top and Front Views
- C. Placing Details in the Top View
- D. Placing Details in the Front View
- E. Heavying-in all Lines in the Top and Front Views

Task #4 Draw the Top, Front and Right Side Views
Unit of Operation
- A. Drawing the Border and Title Block on the Paper
- B. Blocking-in the Top, Front and Right Side Views
- C. Blocking-in the details in the Top View
- D. Blocking-Details in the Front and Right Side Views
- E. Projecting Details into the Top and Right Side Views
- F. Heavying in all Lines of the Top, Front and Right Side Views

Task #5 Draw a Drilled Hole
Unit of Operation A.

Task #6 Draw a Drilled and Reamed Hole
Unit of Operation A.

Task #7 Draw a Drilled and Counterbored Hole
Unit of Operation A.

Task #8 Draw a Drilled and Spotfaced Hole
Unit of Operation A.

Task #9 Draw a Drilled and Countersunk Hole
Unit of Operation A.

Task #10 Label the Top, Front and Right Side Views
Unit of Operation
A. Drawing the Border and Title Block on the Paper
B. Drawing the Top, Front and Right Side Views
C. Labeling the Top, Front and Right Side Views

Task #11 Draw the Development of Rectanglar Prism
Unit of Operation
A. Drawing the Border and Title Block on the Paper
B. Blocking-in the Top View, Front View and the Development of the Prism
C. Labeling the Top and Front Views
D. Laying-out the Development of the Prism
E. Labeling and Heavying-in the Development

Task #12 Draw the Development of a Cylinder
Unit of Operation
A. Drawing the Border and Title Block on the Paper
B. Blocking-in the Top View, Front View and Development of a Cylinder
C. Blocking-in the Detail of the Top View Front View and the
D. Heavying-in all Centerlines and the Top Viewing, and Labeling the Top View
E. Heavying-in and Labeling the Front View and the Development of the Cylinder

Task #13 Draw the Development of a Pyramid
Unit of Operation
A. Drawing the Border and Title Block on the Paper
B. Blocking-in the Top and Front Views of the Pyramid
C. Labeling the Top View and Front View of a Pyramid
D. Laying-out the Development of a Pyramid
E. Heavying-in all Lines of the Development of a Pyramid

HEALTH SERVICES

Task 1: Put On & Remove Face Mask

Task 2: Put On & Remove Sterile Gloves

Task 3: Filling & Applying the Ice Bag

Task 4: Collecting Sputum Specimen

Task 5: Filling & Applying Hot Water Bag

Task 6: Collect Urine Specimen

Task 7: Collect 24 hr. Urine Specimen

Task 8: Transporting Patient from Bed to Stretcher

Task 9: Taking the Radial Pulse

Task 10: Making an Occupied Bed

Task 11: Making a Post-Operative Bed

Task 12: Bathing an Infant

Task 13: Handwashing

Task 14: Taking Apical Pulse

Task 15: Using Hematest Tablet

Task 16: Using Albastix

Task 17: Taking Axillary Temperature

Task 18: Using Clinitest Tablet

Task 19: Measuring Fluid Intake & Output

Task 20: Gown Technique

Task 21: Moving the Patient Up in the Bed

Appendix C

PIVOT Units Selected by the Participating

Teachers for Use in the Experiment

INDUSTRIAL ELECTRICITY UNITS

Task #52 Replace a Defective Single Pole Manual Motor Starter

Task #60 Replace a Defective Control Coil in an Across-the-Line Starter

Task #61 Replace a Defective Overload Relay in an Across-the-Line Starter

Task #62 Install an Overload Heater in a Manual Motor Starter

Task #64 Wire a Stop-Start Pushbutton Station to an Across-the-Line Starter

Task #69 Operate a Two Wire Control Circuit

Task #70 Operate a Three Wire Control Circuit

Task #71 Troubleshoot a Two Wire Control Circuit

Task #74 Troubleshoot the Control Circuit of an Across-the-Line Starter

AUTOMOTIVE UNITS

Task #19 Clean High Tension Ignition Wires and Towers

Task #20 Connect and Operate a Remote Control Starter Switch

Task #21 Connect and Operate a Timing Light

Task #22 Replace Ignition Wires

Task #24 Check the Resistance of Spark Plug Wires

Task #25 Locate and Mark Ignition Timing Marks

Task #26 Remove and Install a Distributor in an Engine Mounted on an Engine Stand

Unit A. Removing a Distributor from an Engine
Unit B. Installing a Distributor in an Engine

Task #27 Locate Number One Firing Position with the Distributor Removed

MACHINE SHOP UNITS

Task #21 Set Up Round Material in a Vise on a Vertical Milling Machine to Cut a Flat Surface

- Unit A. Mounting a Collet and Cutter on a Vertical Milling Machine
- Unit B. Mounting a Vise on a Vertical Milling Machine
- Unit C. Mounting a Workpiece on a Vertical Milling Machine

Task #22 Set the Spindle Speed for Cutting a Flat Surface on Round Material

- Unit A. Setting the Spindle Speed on a Vertical Milling Machine
- Unit B. Starting and Stopping a Vertical Milling Machine

Task #23 Mill a Flat Surface on Round Material with a Vertical Milling Machine

- Unit A. Taking a Trial Cut on a Vertical Milling Machine
- Unit B. Making the First Cut on a Vertical Milling Machine
- Unit C. Making the Second Cut on a Vertical Milling Machine

Task #24 Breakdown of a Vertical Milling Machine after Completing the Flat Cut on Round Material

- Unit A. Removing the Workpiece from the Vertical Milling Machine
- Unit B. Removing the Cutter and Collet from a Vertical Milling Machine

Task #25 Final Breakdown and Cleanup of a Vertical Milling Machine

DRAFTING UNITS

Task #11 Draw the Development of a Rectangular Prism

- Unit A. Drawing the Border and Title Block on the Paper
- Unit B. Blocking-in the Top View, Front View, and the Development of the Prism
- Unit C. Labeling the Top and Front Views
- Unit D. Laying Out the Development of the Prism
- Unit E. Labeling and Heavying-in the Development

Task #12 Draw the Development of a Cylinder

- Unit A. Drawing the Border and Title Block on the Paper
- Unit B. Blocking-in the Top View, Front View, and Development of the Cylinder
- Unit C. Blocking-in the Detail of the Top View, Front View, and Development
- Unit D. Heavying-in all Centerlines and the Top Viewing, and Labeling the Top View
- Unit E. Heavying-in and Labeling the Front View and the Development of the Cylinder

Task #13 Draw the Development of a Pyramid

- Unit A. Drawing the Border and Title Block on the Paper
- Unit B. Blocking-in the Top and Front Views of the Pyramid
- Unit C. Labeling the Top and Front Views of the Pyramid
- Unit D. Laying-out the Development of a Pyramid
- Unit E. Heavying-in all Lines of the Development of a Pyramid

NURSE'S AIDE UNITS

Task #1 Put on and Remove a Face Mask

Task #5 Filling and Applying a Hot Water Bag

Task #6 Collecting a Urine Specimen

Task #10 Making an Occupied Bed

Task #13 Handwashing

Appendix D

Criterion Tasks and Checklists Related to Them

Criterion Test -- Industrial Electricity

Instructions to Student

There is a defective part in the across-the-line starter that you have been given. Trouble-shoot the starter using the Amprobe and replace the defective part. Your performance will be evaluated on the basis of whether or not you followed the correct procedures to do the job, and the quality of the finished job. There is no specific time limit, but you should work at an efficient pace.

Criterion Test -- Industrial Electricity

Student's Name:_____

Book No.:_____School_____

Grader's Name:_____Date of test_____

In this test, the student is expected to locate a defective part in an across-the-line starter, using the Amprobe, and then to replace the defective part. The checklist below is a guide to follow in the evaluation of how effectively the student completed this task. After the student has completed the task, please assign him a grade of Pass or Fail.

Checklist

1. Was the student safely attired?
2. Did the student shut off the power?
3. Did he set up the Amprobe properly?
4. Was he able to locate the defective part?
5. Did the student replace the defective part correctly?
6. Did he reassemble the unit correctly (replace cover)?
7. Did he test the operation of the unit?
8. Did the student observe correct safety procedures and care for the equipment properly?

On the basis of what you have seen, decide whether or not the student has done this job well enough to be said to have developed "entry level competency" in this task. On the basis of your judgment, check Pass or Fail, below.

Pass Fail

Criterion Test -- Automotive

Instructions to Student

For this test, you are expected to do the following things:

(1) Locate and mark the ignition timing marks.

(2) Remove the distributor from the engine.

(3) Locate the #1 firing position with the distributor removed from the engine.

(4) Reinstall the distributor in the engine.

(5) Start the engine.

You will be graded on whether or not you followed correct procedures for the job and the quality of the finished job. There is no specific time limit, but you should work at an efficient pace.

Criterion Test -- Automotive

Student's Name:_____

Book No:_____School_____

Grader's Name:_____Date of test_____

Checklist

1. Was the student safely attired?
2. Did the student attach the remote control starter switch correctly?
3. Did the student mark the ignition timing marks correctly?
4. Did the student disconnect the coil wire and the vacuum line, remove the distributor cap, remove the hold-down bolt, and pull the distributor?
5. Did the student correctly identify the #1 cylinder?
6. Did the student bring the timing marks together on the compression stroke of the #1 cylinder?
7. Did the student reinstall the distributor, replace the hold-down bolt, replace the distributor cap, and replace the coil wire and vacuum line correctly?
8. Did the student observe correct safety procedures and care for the equipment properly?
9. Did the engine start?

On the basis of what you have seen, decide whether or not the student has done this job well enough to be said to have developed "entry level competency" in this task. On the basis of your judgment, check Pass or Fail, below.

Pass Fail

Criterion Test -- Machine Shop

Instructions to Student:

Set up the provided work piece on the vertical milling machine and make two flat cuts of 60 thousandths of an inch (0.060") each, along the length of the piece. The milling machine speed has already been set correctly for this job, and the vise has been mounted correctly. After you have made the two cuts, break down the set up of the machine, making sure that you follow proper procedures with regard to safety and correct care and operation of the machine. Leave the vise mounted as you found it. Your performance will be judged on the basis of whether or not you followed correct procedures in doing the job, and the quality of the finished job. There is no specific time limit, but you should work at an efficient pace.

Criterion Test -- Machine Shop

Student's Name:_____

Book No:_____School:_____

Grader's Name:_____Date of test:_____

In this test, the student is expected to set up the provided work piece on the vertical milling machine and then tc make two flat cuts of 0.060" each. He is then to break down the set up of the machine. The checklist below is a guide to follow in the evaluation of how effectively the student completed this task.

Checklist

1. Was the student safely attired?
2. Was the cutter mounted correctly?
3. Was the workpiece mounted correctly?
4. Did the student locate the work correctly in relation to the cutter?
5. Was the correct procedure followed in turning on the equipment?
6. Did the student make a trial cut correctly?
7. Was an accurate first cut made?
8. Was an accurate second cut made?
9. Was the correct breakdown and cleanup procedure followed?
10. Did the student observe correct safety procedures and care for the equipment properly?

On the basis of what you have seen, decide whether or not the student had done this job well enough to be said to have developed "entry level competency" in this task. On the basis of your judgment, check Pass or Fail, below.

✓

Pass Fail

Criterion Test -- Nursing

Instructions to Student

Using the methods you have been taught in this course, please do the following things:

(1) Put on a face mask.

(2) With the face mask on, take a urine specimen from the patient.

(3) Remove the face mask.

You will be graded on how well you did these things, according to what you have been taught. There is no exact time limit, but you should work at a reasonable speed.

Criterion Test -- Nursing

Student's Name:_____

Book No:_____School:_____

Grader's Name:_____Date of test:_____

In this test, the student is expected to put on a face mask, take a urine specimen from the patient, and remove the face mask. The checklist below is a guide for you to follow in evaluating how well the student did these things. After the student has completed the test, please assign him a grade of Pass or Fail.

1. Were student's nose and mouth properly covered?
2. Were the top strings tied first?
3. Was the mask properly tightened?
4. Did the student select the correct equipment? (Face mask, hand washing equipment, bedpan, graduate, specimen container, name tag)
5. Did the student present the bedpan properly?
6. Did the student place the specimen in the graduate?
7. Did the student transfer the specimen to the specimen container properly?
8. Did the student wash his hands before removing the face mask?

On the basis of what you have seen, decide whether or not the student has done this job well enough to be said to have developed "entry level competency" in this task. On the basis of <u>your</u> judgment, check Pass or Fail, below.

Pass Fail

Appendix E

Rating Form for Individual Slides and

Definitions of Possible Defects

Name of Unit _____ Unit number _____

Slide Number	Safety (unsafe method)	Poor slide quality	Bad camera angle	Incorrect set-up or arrows wrong	Incorrect procedure shown	Poor sound track (recording quality)	Misc. (specify below)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

Over-all problems (illogical sequence, etc.), and "Misc." from above:

Definitions of Column Headings on Slide Evaluation Form

Safety (unsafe method) -- This refers to any procedures or techniques shown in the slide or described in the script which present an unnecessary safety hazard to the student. It can also be used to indicate that the method shwon is not as safe as one now used in industry, even though it was once considered acceptable.

Poor slide quality -- This refers to the photographic quality of the slide, such as lighting, visibility of drawn lines, focus, or poor color quality (where relevant).

Bad camera angle -- Refers to the composition of the picture, the distance from the subject, failure to include important items in the picture, use of an angle (such as directly down from the ceiling) from which a student could not see the subject (and which is therefore of little use to him in understanding the material).

Incorrect Set-up or arrows wrong -- To be used when the equipment shown is not appropriate for what the sound track describes, or is not what is needed for the task, or when the arrows included in some pictures point to the wrong things, or in the wrong direction.

Incorrect procedure shown -- To be used when the procedure described is not one that is considered acceptable, according to the usual standards of the industry. That is, when mastery of the technique shown would cause a student to do a job in an unacceptable way.

Poor sound track (recording quality) -- Words unintelligible, part of sound track clipped off in recording, distracting noises on sound track, etc.

Misc. -- Any other defect in the individual slide/sound track which could and should be corrected, to improve the quality of the slide. Over-all defects in the entire unit will be described at the bottom of the page.

Appendix F

Sample of the Printed Materials Used with the PIVOT Units

D.O.T. 824:61-A
Electrical Construction

STUDENT REVIEW AND EVALUATION SHEET

TASK: **61. Replace a Defective Overload Relay in an A.T.L.S.**

UNIT OF OPERATION: (61-A) Replace a Defective Overload Relay A.T.L.S.

PROVIDED: An across-the-line starter, new overload relay, screwdriver, safety glasses.

CRITERIA: Learner will remove and replace a defective overload relay in an across-the-line starter without damage to the equipment or injury to himself.

OVERVIEW: Overload relays of a starter serve to prevent a motor from drawing excessive current that is destructive to motor insulation. If an overload relay is defective the motor starter, may or may not start the motor, but it will definitely not protect the motor from drawing excessive current. Some of the things that will cause an overload relay to become defective are corrosion, dirt, worn parts, mechanical binding, and contacts that were previously damaged by a short circuit. Electricians are often required to replace defective load relays on motor starters in all types of commercial and industrial buildings.

Before you call your instructor for evaluation, check yourself on the STUDENT CHECKLIST below.

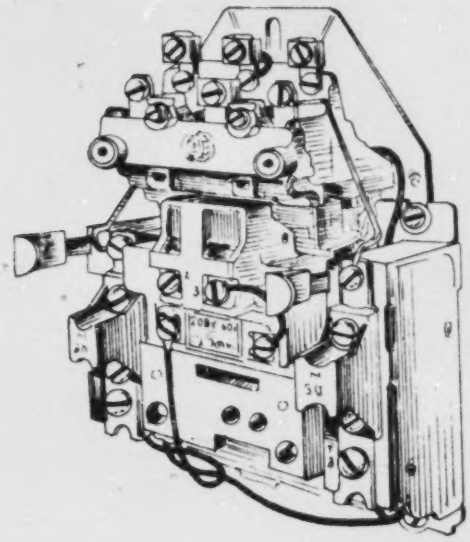
STUDENT CHECKLIST DID YOU:		INSTRUCTOR CHECKLIST DID THE LEARNER
☐	1. Remove overload heater	☐
☐	2. Remove jumper wire from overload relay	☐
☐	3. Remove control wire from overload relay	☐
☐	4. Remove overload relay from starter	☐
☐	5. Install new overload relay on starter	☐
☐	6. Connect jumper wire in place	☐
☐	7. Connect both control wires in place	☐
☐	8. Install overload heater on relay	☐
☐	9. Make sure that there was no damage to equipment or injury to self	☐
	Instructor: Did the learner replace a defective overload relay in an across-the-line starter?	☐

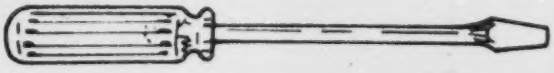
Completion of Unit Approved by _____
Authorized Signature

WORK STATION

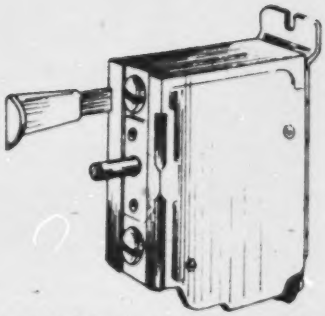
TASK: 61. Replace a Defective Overload Relay in an A.T.L.S.

UNIT OF OPERATION: (61-A) Replace a Defective Overload Relay A.T.L.S.





SCREWDRIVER



OVERLOAD RELAY

SAFETY GOGGLES

Appendix G

Questionnaires

For multiple-choice items, the total number of individuals who picked each choice is shown in the answer spaces.

NAME_____ Shop Area_____ School_____

PIVOT RESEARCH PROJECT CONTROL GROUP QUESTIONNAIRE

Please answer the following questions as accurately as possible. This questionaire is intended simply as a method of accounting for a number of variables that may exist within control group classes and which may affect eventual data analysis. Your identity is not important except as it determines the occupational area involved. If for any reason you do not wish to answer any question, simply skip it.

1. How many students in your subject class do you expect to have successfully learned the designated tasks or activities by May 1st?

   Mean = 10.7

2. If testing occurs between May 1st and June 15th, when would you like us to test your class? (i.e. early or late)

   All said in May

3. Is it likely that there will be a serious absentee problem in your classes during the last few weeks of the school year?

   Yes = 4 No = 3

4. What is the approximate ethnic breakdown of your participating class?

   Black Range 4-100% Mean 69% | White Range 0-96% Mean 30% | Spanish Speaking 10% (one class only) | Other 0%

5. Are the tasks we have asked ycu to teach for the PIVOT project normally a part of the curriculum that you are teaching to the participating class?

   All 4 Most 2 Few 1 None 0

6. In reference to the last question, if not all, has this project meant a radical change in your curriculum for these students?

   No = 5 No Answer = 2

7. Have you informed the subject class that they are participating in an experimental study?

   Yes = 7 No = 0

8. Have you informed your class which tasks or activities are included in the PIVOT study?

   Yes = 6 No = 1

9. If yes, have the students shown any difference in their learning behavior toward these particular tasks?

   (If yes, use other side to tell how) Yes = 2 No = 5

10. Have you emphasized the importance of the experimental tasks in your teaching of them?

    Yes = 4 No = 3

11. Do you see this experimental study as a competition between your participating class and its counter-part?

    Yes = 2 No = 5

12. If your students are familiar with the nature of this experiment, do they regard it as a competition with the other class?

    No = 6 Somewhat = 1

13. Do you consider the experimental tasks or activities to be too advanced or too difficult for your control class?

    No = 7 Yes = 0

14. Too easy?

    No = 6 No Answer = 1

15. Have you treated the experimental tasks or activities the same way that you have treated other classroom instruction, or have you separated them?

    Same Way = 7

16. What percentage of your classroom time is generally spent in teaching the entire class, what % on small groups, what % on individual instruction?

    Entire Class Mean = 39% Small Groups Mean = 28%

    Individual Instruction Mean = 36%

17. During any typical classroom period, how many of the students in your subject group are usually working independently?

    Mean = 77%

18. Do you have access to audio-visual aids for use in your classroom or shop?

    Yes = 4 No = 2 No Answer = 1

19. How frequently do you employ audio-visual aids in your classroom or shop? (Check One)

    Frequently 2 Sometimes 2 Seldom 2 Never 1

20. Are you satisfied with the content of these audio-visual materials?

Very Satisfied 0 Moderately Satisfied 2

Varying Quality 3 Barely Acceptable 1

Useless 0 Not Available 0

21. Do you feel that your subject area lends itself easily to the development of audio-visual materials?

Yes = 4 No = 2 No Answer = 1

22. Would you like to have more audio-visual materials?

Yes = 7 No = 0

23. Would you be willing to develop audio-visual materials for use in your shop only?

Yes = 5 No = 2

24. Would you be willing to develop audio-visual materials for use in other shops in your subject area?

Yes = 5 No = 1 No Answer = 1

25. How does the equipment in your shop compare with that used in industry? (Check One)

Favorably 2 Acceptably 3 Poorly 2

26. What percentage of your students would you estimate eventually obtain employment in your occupational category or related fields?

Mean = 39%

27. What percentage of your students would you estimate are in your classes because they chose that field of study?

Mean = 75%

28. What percentage of the students in your classes are there for no particular reason?

Mean = 13%

29. How many weeks of classroom time do you estimate are required to teach all of the tasks or activities involved in this experiment?

Mean = 5.2 weeks

30. Do you have all of the materials necessary to teach the designated tasks or activities? (Yes or No)

Yes = 6 No = 1

31. If the answer to the last question is No, use the other side of the paper to explain what materials you lack, and how you have dealt with the situation.

32. Do you anticipate any difficulties in finishing the designated subject matter by May 1st. (Yes or No)

Yes = 1 No = 6

33. If yes, use other side of paper to explain what difficulties you expect to have, or when you do expect to finish.

Name_____ Shop Area_____ School_____

PIVOT RESEARCH PROJECT EXPERIMENTAL GROUP QUESTIONNAIRE

Please answer the following questions as accurately as possible. This questionaire is intended simply as a method of accounting for a number of variables that may exist within experimental group classes and which may affect eventual data analysis. Your identity is not important except as it determines the occupational area involved. If for any reason you do not wish to answer a question, simply skip it.

1. How many students in your experimental class do you expect to have learned the designated tasks by May 1st?

   Mean = 14.2

2. If testing occurs between May 1st and June 15th, when would you like us to test your class? (i.e. early in this period or late?)

   No Answer = 3 Early = 4 Late = 4

3. Is it likely that there will be a serious absentee problem in your classes during the last few weeks of the school year?

   No Answer = 1 Yes = 3 No = 5 Do No Know = 1

4. What is the approximate ethnic breakdown of your participating class?

   Range 10 - 100% Range 1 - 88% Range 0 - 10%
   Black M = 55% White M = 45% Spanish-Speaking M = 4%

   Other In One Class = 1%

5. Are the tasks we have asked you to teach for the PIVOT project normally a part of the curriculum that you are teaching to the participating class? (Check One)

   All 7 Most 3 Few 0 None 1

6. In reference to the last question, if not all, has this project meant a radical change in your curriculum for these students?

   Yes = 2 No = 6 No Answer = 3

7. Do you consider the experimental tasks or activities to be too advanced or difficult for your subject class?

   No = 10 No Answer = 1

8. Too easy?

   Yes = 1 No = 7 Some = 1 No Answer = 2

9. What percentage of your classroom time is usually spent in teaching the entire class, what % on small groups, what % on individual instruction?

   Entire Class M = 19% Small Groups M = 22 %

   Individual Instruction M = 57%

10. Have you informed your experimental class that they are, in fact, participating in an experimental study?

    Yes = 9 No = 2

11. During a typical classroom period, what percentage of the students in your experimental class are usually working on the experimental materials?

    Mean = 37%

12. Do you have access to other audio-visual aids for use in your classroom or shop?

    Yes = 10 No = 1

13. How frequently do you employ other audio-visual aids in your classroom or shop? (Check One)

    Frequently 4 Sometimes 5 Seldom 2 Never 0

14. Are you satisfied with the content of these other audio-visual materials? (Check One)

    Very Satisfied 2 Moderately Satisfied 4

    Varying Quality 4 Barely Acceptable 1

    Useless 0 Not Available 0

15. Do you feel that your subject area lends itself easily to the development of audio-visual aids?

    Yes = 10 No = 1

16. Would you like to have more audio-visual materials?

    Yes = 10 No = 1

17. Would you be willing to develop audio- visual materials for use in your shop or classroom only?

    Yes = 9 No = 1 No Answer = 1

18. Would you be willing to help develop audio-visual materials for use in other shops or classrooms in your subject area?

    Yes = 9 No = 2

19. How does the equipment in your shop compare with that used in industry? (Check One)

    Favorable 4 Favorable (some items missing) 3

    Acceptable 3 Poor 1

20. What percentage of your students would you estimate eventually obtain employment in your occupational category or related fields?

    Mean = 39%

21. What percentage of your students would you estimate are in your classes because they chose that field of study?

    M = 74%

22. What percentage of your students would you estimate are in your classes for no particular reason?

    M = 28%

23. How many weeks of classroom time do you estimate are required to teach all of the tasks or activities involved in this experiment?

    M = 7.6 weeks

24. Do you have all of the materials and equipment necessary to teach the designated tasks or activities? (Yes or No)

    Yes = 8 No = 3

25. If the answer to the last question is No, use the other side of this paper to explain what materials you lack, and how you have dealt with this situation.

26. Do you anticipate any difficulties in finishing the designated subject matter by May 1st? (Yes or No)

    Yes = 2 No = 9

27. If yes, use the space below to explain the types of difficulties you expect to have, or when you do expect to finish.

4/27/76

PIVOT RESEARCH PROJECT

EXPERIMENTAL GROUP QUESTIONNAIRE

Name_____ Shop Area_____ School_____

Your answers to the following questions will be of considerable help to us in evaluating the effectiveness of the 3M Sound-on-Slide materials that you used in class. Please answer all questions as completely as possible, especially those that request further information concerning your reactions. In all cases, what is desired is your personal reaction, based on your own experience with the specific slide units that you used.

1. How effective do you think the 3M Sound-on-Slide units used in your classes were in teaching the material covered in them?

   (A) Very Effective (B) Effective
   (C) Ineffective (D) Very Ineffective

   A = 3
   B = 6
   C = 1
   1. D = 1

2. How enthusiastic are you about using the Sound-on-Slide units you have been given instead of the method you would ordinarily use to teach the same material?

   (A) Very Enthusiastic (B) Enthusiastic
   (C) Reluctant (D) Very Reluctant

   A = 1
   B = 7
   C = 2
   2. D = 1

3. Does it seem to you that your students were <u>generally</u> able to understand the material in the Sound-on-Slide units? (answer Yes or No)

   Yes = 11
   3. No = 0

4. Did your students generally seem willing to use these units without constant supervision and monitoring? (Yes or No)

   Yes = 8
   4. No = 3

5. Did you have any difficulties in implementing the 3M Sound-on-Slide units in your class? (answer Yes or No)

   Yes = 5
   5. No = 6

   If your answer to #5 was "yes," please describe on the back of this page the difficulties that you had.

6. How would you rate the ruggedness and reliability of the 3M projectors that your students used in class?

   (A) Very rugged and reliable
   (B) Fairly rugged and reliable
   (C) Somewhat troublesome, requiring fairly frequent maintenance
   (D) Very troublesome, requiring very frequent maintenance

   A = 1
   B = 4
   C = 5
   6. D = 1

7. How much involvement on your part was necessary for your students to be able to learn from the Sound-on-Slide units?

(A) A great deal (B) A moderate amount
(C) Very little (D) Almost none at all

A = 1
B = 5
C = 4
7. D = 1

8. How appropriate and useful have you found the pre-tests, post-tests and Student Review and Evaluation Sheets that came with your units?

(A) Very appropriate and useful
(B) Somewhat appropriate and useful
(C) Somewhat inappropriate and not particularly useful
(D) Very inappropriate and generally useless
(E) No such materials were provided with the units

A = 2
B = 5
C = 3
D = 0
8. E = 0

9. How useful do you feel the Sound-on-Slide units that you have been given have been in helping you to teach your subject this year?

(A) Very useful (B) Moderately useful
(C) Not of much use (C) Of almost no use at all

A = 5
B = 3
C = 1
9. D = 2

10. Do you feel that the use of the Sound-on-Slide units has, for the most part, been beneficial to you and your students?

(A) Very beneficial (B) Somewhat beneficial
(C) Not very beneficial (D) Not beneficial at all

A = 3
B = 6
C = 2
10. D = 0

11. Do you feel it is a good idea to use the Sound-on-Slide method of instruction as a major part of the curriculum in your subject area?

(A) An excellent idea (B) A good idea
(C) Somewhat doubtful (D) Probably not a good idea

A = 2
B = 4
C = 4
11. D = 1

12. Do you feel that the Sound-on-Slide method is best used as an aid to conventional instruction, rather than as a major curriculum component?

(A) Definitely (B) Probably
(C) Probably not (D) Definitely not

A = 8
B = 3
C = 0
12. D = 0

13. Do you feel that the Sound-on-Slide units you have been given fit the conditions and material in your own shop? (answer Yes or No)

13. Yes = 7 No = 4

If you answered "no" to #13, please explain your answer in more detail on the back of this page.

14. Do the techniques shown in the Sound-on-Slide units agree with what you would consider a proper way to do the jobs shown?

(A) Almost always (B) Usually
(C) Sometimes (D) Seldom

A = 6
B = 4
C = 1
14. D = 0

15. Have you noticed any deficiencies in the physical quality of the slide units themselves? That is, any deficiencies in the quality of the photography, camera angles, sound tracks, etc., that impede student use of the units? (Answer Yes or No)

15. Yes = 2 No = 9

16. Which of the following best describes your student's reaction to using the Sound-on-Slide method in class?

(A) Very enthusiastic (B) Enthusiastic
(C) Somewhat reluctant (D) Very reluctant

A = 1
B = 3
C = 5
16. D = 1

17. What impact on classroom management has the introduction of the Sound-on-Slide method had in your classes?

(A) It has made classroom management easier
(B) There has been no change in classroom management problems
(C) It has made classroom management more difficult

A = 5
B = 4
17. C = 2

18. Are your students able to successfully complete the units that they are given?

(A) Always (B) Very often
(C) Not very often (D) Almost never

A = 1
B = 8
C = 1
18. D = 1

19. Do you feel a need for more staff development than you received in order to be able to use the Sound-on-Slide method successfully? (Answer Yes or No; if you answer "yes," an explanation on the back of this page would be appreciated.)

19. Yes = 0 No = 10 No Answer = 1

20. How important do you think it is that the equipment shown in a Sound-on-Slide unit exactly match the equipment in the shop where the unit is to be used?

(A) Extremely important (B) Important
(C) Not very important (D) Not important at all

A = 10
B = 1
C = 0
20. D = 0

21. Would you be willing to write Sound-on-Slide units specifically for use in your own shop? (Answer yes or no; feel free to expand on your answer, if you wish)

Yes = 9
21. No = 2

22. Would you be willing to write Sound-on-Slide units for use in other teachers' shops? (Yes or No)

Yes = 7
22. No = 4

23. Since the main purpose of this questionnaire is to determine your reactions to the Sound-on-Slide units, we would appreciate any comments you may have that will either serve to explain some of your responses to these questions or to clarify your feelings about the units. Please indicate on the back of this page anything that you feel is important, especially those things that you think were not dealt with adequately in the preceding questions.

SCHOOL DISTRICT OF PHILADELPHIA
Office of Research and Evaluation
Priority Operations Evaluation Services

April, 1976

To the teachers at the Skills Center:

This year, a project has been funded through the Office of Career Education Planning and Development to evaluate the effectiveness of the 3M Sound-on-Slide (PIVOT) materials in various educational settings. Since one of the settings in which the Sound-on-Slide materials are being used is the Randolph Skills Center, your cooperation in completing the attached questionnaire will be very much appreciated. The questionnaire is intended to determine your reaction to the Sound-on-Slide materials that you personally have used. Your reactions will be of considerable help to us, as project evaluatiors, in making suggestions concerning the effectiveness of these materials. The completed questionnaire should be returned to your coordinator.

Thank you,

Leonard Kindler
Research Assistant
PIVOT Evaluation Project

Questionnaire for teachers at the Skills Center:

Name _____

Subject(s) taught for which 3M Sound-on-Slide units have been provided _____

1. For about what percentage of the subject matter that you teach have you been provided with 3M Sound-on-Slide units?

1. Mean = 34%

2. Check those uses towhich you have so far put the 3M Sound-on-Slide units (check all that apply):

Total Checked		
21	a.	Initial instruction in an area, with individual students.
20	b.	Review of previously taught material, with individual students.
19	c.	Initial instruction in an area, with groups of students.
16	d.	Review of previously taught material, with groups of students.
16	e.	Helping absentees to "catch up."
19	f.	As a teaching aid while instructing the whole class at once.
2	g.	Other (describe on back of page).

3. Give the letter of the choice in #2 which represents the main use to which you have put the 3M Sound-on-Slide units.

a = 16 e = 0
b = 4 f = 2
c = 2 g = 0
3. d = 1

4. During what percentage of class time would you estimate that the 3M Sound-on-Slide units are in use in your classes (in any way)?

4. Mean = 22%

5. How effective do you feel the units used in your classes are in teaching the material covered in them?

(A) Very effective (B) Effective
(C) Ineffective (D) Very ineffective

A = 7 D = 0
B = 15 B & C = 1
5. C = 2

6. How enthusiastic are you about using the Sound-on-Slide units you have been given instead of the method you would ordinarily use to teach the same material?

(A) Very enthusiastic (B) Enthusiastic
(C) Reluctant (D) Very reluctant

A = 4
B = 18
C = 3
6. D = 0

7. Does it seem to you that your students are generally able to understand the material in the Sound-on-Slide units? (answer Yes or No)

Yes = 23
7. No = 2

8. Do your students generally seem willing to use these units without constant supervision and monitoring? (Yes or No)

Yes = 17
8. No = 8

9. Have you had any difficulties in implementing the 3M Sound-on-Slide units in your classes? (Answer Yes or No)

Yes = 12
9. No = 13

If you answered yes to #9, please describe the difficulties you have had on the back of this page.

10. How would you rate the ruggedness and reliability of the 3M Sound-on-Slide projectors, based on your personal experience with them in classroom use?

(A) Very rugged and reliable (B) Fairly rugged and reliable
(C) Somewhat troublesome, requiring fairly frequent maintenance
(D) Very troublesome, requiring very frequent maintenance

A = 3
B = 7
C = 10
10. D = 5

11. How much involvement on your part is necessary in order for your students to be able to learn successfully from the Sound-on-Slide units?

(A) A great deal (B) A moderate amount
(C) Very little (D) Almost none at all

A = 10
B = 10
C = 5
11. D = 0

12. How appropriate and useful have you found the pre-tests, post-tests and Student Review and Evaluation Sheets that came with your units?

(A) Very appropriate and useful (B) Somewhat appropriate and useful
(C) Somewhat inappropriate and not particularly useful
(D) Very inappropriate and generally useless
(E) No such materials were provided with the units

A = 5
B = 9
C = 5
D = 1
E = 4
12. No Answer = 1

13. How useful do you feel that the Sound-on-Slide units that you have been given have been in helping you teach your subject(s) this year?

(A) Very useful (B) Moderately useful
(C) Not of much use (D) Of almost no use at all

A = 9
B = 10
C = 6
13. D = 0

14. Do you feel, based on your experience with the students you have met, that the use of Sound-on-Slide units is necessary in order for you to be able to successfully conduct your classes?

(A) Very necessary (B) Somewhat necessary
(C) Not particularly necessary (D) Not necessary at all

A = 6
B = 7
C = 12
14. D = 0

15. Do you feel that the use of the Sound-on-Slide units has, for the most part, been beneficial to you and your students?

(A) Very beneficial (B) Somewhat beneficial
(C) Not very beneficial (D) Not beneficial at all

A = 9
B = 13
C = 3
15. D = 0

16. Do you feel it is a good idea to use the Sound-on-Slide method of instruction as a major part of the curriculum in your subject area?

(A) An excellent idea (B) A good idea
(C) Somewhat doubtful (D) Probably not a good idea

A = 11
B = 8
C = 2
16. D = 4

17. Do you feel that the Sound-on-Slide method is <u>best</u> used as an <u>aid</u> to conventional instruction, rather than as a major curriculum component?

(A) Definitely (B) Probably
(C) Probably not (D) Definitely not

A = 16
B = 4
C = 4
17. D = 1

18. Do you feel a need for more staff development sessions, to learn to use the Sound-on-Slide materials in your own shop? (Answer yes or no; if "no," please explain on back of page.)

18. Yes = 18
No = 7

19. Do you feel that the Sound-on-Slide units that you have been given fit the conditions and materials in your own shop? (Answer yes or no; if "no," please explain on back of page.)

19. Yes = 17
No = 8

20. Since the main purpose of this questionnaire is to determine your reactions to the Sound-on-Slide units, we would appreciate any comments you may have that will either serve to explain some of your responses to these questions or to clarify your feelings about the units. Feel free to mention on the back of this page anything that you feel is important, especially if you feel that the matter was not dealt with adequately in the preceding questions.

CONSULTANT QUESTIONNAIRE #1

Name_____

Occupational Area_____

You have seen and been involved with the PIVOT system in one occupational area. On the basis of your experience, please comment briefly on your perception of the PIVOT system. Please include fairly specific comments on the overall quality of the curriculum materials you saw, and include any suggestions for improving the content or utilization of PIVOT in teaching vocational education. In addition, express your opinion on the suitability of the PIVOT system in meeting the needs of industry as prospective employers of Philadelphia School District students. Please use additional paper if necessary.

(This questionnaire was designed for use by the industrial consultants.)

CONSULTANT QUESTIONNAIRE #2

Name_____

Occupational Area_____

You have seen and been involved with the PIVOT system in one occupational area. On the basis of your experience, please comment briefly on your perception of the PIVOT system. Please include fairly specific comments on the overall quality of the curriculum materials you saw, and include any suggestions for improving the content or utilization of PIVOT in teaching vocational education. In addition, please express your opinion of the suitability of the PIVOT system in meeting the needs of vocational education students in the School District of Philadelphia. Please use additional paper if necessary.

(This questionnaire was designed for use by the School District consultants.)